Urban Stormwater Structural Best Management Practices (BMPs), AG-588-1, available through your local Cooperative Extension center.

Selecting a BMP depends on many factors, including available land and its cost, homeowner and community attitudes, topography, source and type of pollution, soil type, watershed size, and land cover. In areas where land is limited, where aesthetics are an important concern of the community (or homeowner), where nuisances need to be avoided at all cost, or where "childproof" safety is required, rain gardens may prove to be the optimal BMP to install.

Rain Gardens: What Are They?

Pioneered in Prince George's County, Maryland, rain gardens are designed to merge two important goals: aesthetics and water quality. Rain gardens (also known as bio-retention areas) are intended to be landscaped areas that treat stormwater runoff. Homeowners or custodians can treat these gardens, giving them significant attention, or they can blend them into the landscape and make them look "natural." Whatever the context, a rain garden should look like part of the landscape: plants—particularly shrubs and trees—surrounded by mulch.

However, the true nature of a rain garden is to treat stormwater. Water is directed into them by pipes, swales, or curb openings. The garden is a depression or bowl that temporarily holds water, as opposed to shedding it away. The trees and shrubs growing in rain gardens are water tolerant, rather than water loving (as discussed later).

Figure 1. Rain garden installed at Neuseway Nature Center (Kinston, N.C.). Stormwater runoff enters through the 6-inch-diameter pipe near the right foreground. The garden receives rainfall from a nearby rooftop. This rain garden is a small depression in sandy soil. The mulch is hardwood.

Rain gardens can be installed in a variety of soil types from clays to sands. A rain garden constructed in sandy soil in Kinston, North Carolina, is shown in Figure 1; a clay soil rain garden in Cary, North Carolina, is shown in Figure 2.

Rain gardens can vary in size. They can be installed in a corner of your lawn, placed along the edges of roads, or put in the medians of parking lots. The size and design of the rain garden depend on the area that drains to it and the type of soil in which the garden is placed.

How Rain Gardens Remove Pollution

Rain gardens remove pollutants using physical, chemical, and biological mechanisms. Specifically, they use absorption, microbial action, plant uptake, sedimentation, and filtration. In addition, rain gardens sited in appropriate soils can be designed to allow infiltration of most stormwater runoff, thus replenishing groundwater. An explanation of each of these mechanisms is provided below and in Table 1.

Absorption is a chemical process that removes some forms of metals and phosphorus. The process takes place on mulch and soil particles lying on the floor of the rain garden. Soil particles have charges—similar to a magnet—as do dissolved metals and soluble phosphorus. When these charges are complementary, dissolved metals and phosphorus are attracted to the open soil particles. This process is called absorption. One drawback to absorption is that there is a finite number of charged soil particles at the bottom of a rain garden. Once all the available charged mulch and soil particles have sorbed with metals and phosphorus, the absorption potential of a rain garden decreases dramatically. Scientists and engineers wrestle with this problem today, but research-

Figure 2. Bio-retention median in a Cary, N.C., parking lot. Bio-retention is a practical alternative for treating stormwater runoff from heavily impervious commercial areas.